5 November, 1999

NGST Ad Hoc Science Working Group
Minutes of ASWG Meeting# 9, 3-5 November, 1999, STScI

Attendees: Russ Alexander, Santiago Arribas, Jill Bechtold, Chuck Bennett, Pierre Bely, Richard Burg, David Crampton, Jim Crocker, Ewine van Dishoeck , Dennis Ebbets, Mike Fall, Harry Ferguson, Bob Fosbury, John Gardner, Paul Geithner, James Graham, Matt Greenhouse, Don Hall, Paul Hicksen, David Hunter, David Hutchings, Peter Jakobsen, Bob Kirshner, Larry Lesyna, Simon Lilly, Olivier LeFevre, Knox Long, Mark McCaughrean, John MacKenty, John Mather, Patrick McCray, Mike Menzel, Mike Meyer, Simon Morris, Jon Morse, Takashi Onaka, Nino Panagia, Bernie Rauscher, Mike Regan, Mike Rich, Marcia Rieke, Shobita Satyapal, Ethan Schreier, Bernie Seery, Gene Serabyn, Eric Smith, Massimo Stiavelli, Peter Stockman, John Trauger, Martin Ward, Bob Woodruff, Gillian Wright.

Not all these people attended all three days. In particular, John Mather returned from a NASA HQ long range planning meeting in Galvaston on Thursday night. He was able to attend on Friday (Nov. 5). The ASWG+ members (ISIM study Principle Investigators and representatives attended the first day and the morning of the second day.

Nov. 3rd

Eric Smith presents Project status: budget ok, wavefront control-OTA now pointed at NEXUS, NRA II will be announced on Dec. 1 with a 90 day reply.

Larry Lesyna presents Lockheed-Martin concept and performance. Emphasizes difference in the ETCs as predicted by L-M and the one done by us. Members ask if the jitter data can be captured and telemetered to the ground a la HST. The answer is “we’ll look at it.”

Dennis Ebbets presents TRW Ball organization and concept. Asks for guidance on the OTA characteristics and science trades.

Stockman describes the agenda and “road to the recommendation.” Simon Lilly emphasizes the need for understanding relative costs.

Geithner presents the results of the first technical panel meeting. All instruments appear feasible but this assumes that the technical issues can be resolved by the time of the NAR (Feb. 2003). Some would require descoping to be “plug compatible” with the yardstick. In terms of technical development risks, the main ones were the MEMS micromirror and microshutter arrays. For the meeting on 22-23 November, the Technical Panel will estimate the costs of bringing these and the other major development areas to the required technical readiness level. Geithner also presented on Nov. 4th the overall results of the parametric cost modeling of the various instruments. Although there was considerable scatter (~30%) in the comparison of estimated costs vs the parametric models, the overall trend was linear. The overall normalization is difficult to establish since these instruments are relatively novel and could only be compared to multi-spectral imagers. The Technical panel will brief the ASWG on any changes that are made in the cost estimates at the Nov. 22-23 meeting.

Visible & Near-IR Camera Subcommittee Report (Massimo Stiavelli): The subcommittee found that a 4'x4' camera with 15-30 filters and Nyquist sampled near 2 microns was an optimum camera. The field could be reduced to reduce cost, although that would mean that a dedicated guider would be needed -- also of order 4' x 4' field. The question was raised whether cost grew with the number of pixels. Some say it is a high power (>1) of the number of pixels (Greenhouse & Bennett).

NIR Spectrograph Subcommittee Report (Marcia Rieke): The committee concluded that the R~100 mode should be as sensitive as possible but did not place a high priority on multiplexing. On the other hand, there was a strong feeling that a R~1000 mode ought to have a high multiplexing capability over a field of about 1-2 arcminutes. Unfortunately, the current multi-slit technologies are not mature. Spatially resolved, R~3000-5000 spectra were third on the priority list and higher resolutions would be mostly useful at wavelengths longward of 2.5 microns, where there is no effective competition from the ground. The FTS advantages and disadvantages were discussed. The FTS niche is full FOV coverage, particularly if the detector noise is high compared to the zodiacal background in a moderate width filter (the ratios of these are the relative speeds of dispersive and FTS spectrographs.)

MIR Subcommittee Report (Mike Meyer): Mike described the wide range of science that could be done with a simple camera/grism combination. The

subcommittee felt that 5-28 microns coverage was important and that the minimum spectroscopic resolution should be R ~1500. There would be significant technical and scientific advantages to having 2 separate channels (5-10,10-28 microns) and this optimum capability was the panel's recommendation.

Nov. 4th

IFTS Presentation (Graham & Bennett)

James Graham and Chuck Bennett described the technical and scientific advantages of an imaging fourier transform spectrometer. Some of the points were: the ratio of speeds of an IFTS and a dispersing spectrograph go approximately as the ratio of backgrounds (dark current, zodiacal background). For wide band imaging, an IFTS would often use regular filters instead of constructing them by scanning. However, if one were going to do a deep wideband filter exposure with a camera, one could break it into a dozen stepped integrations with an IFTS and have half a dozen narrower spectral bands with negligible loss in the overall "panchromatic" wideband image.

The point was made that the IFTS would also use ~ 1000s minimum exposures so that the read noise and readout overhead were minimized. This meant that any many step IFTS program (say R ~ 100) would be very long (~ 10^5-7 s) so that small spectroscopic programs were not a good match to the IFTS, while deep "legacy" programs would yield a wealth of information. In this presentation, Graham and Bennett played down the dispersed IFTS design in favor of the straight IFTS design. One of the basic very deep science modes would be very deep imaging in ~ZJHKLM filters with ~200 steps per filter to achieve very deep imaging and low resolution spectroscopy. Such exposures could be used to look for transient or moving objects such as supernovae, GRBs?, Faint Halo White Dwarfs, faint KBOs, as well as high redshift galaxies.

Cost estimates from Tech Study (Paul Geithner)

Possible Complements of Instruments (Long, Smith)

Based upon the recommendations of the 3 subcommittees, Knox Long and Eric Smith showed possible instrument complements and their pros and cons. Eventually, this presentation will be part of Mather's recommendation to HQ.

NGST Science List (Stiavelli/Rieke/Meyer)

The leads of the three ASWG subcommittees present an informal list of science capabilities for NGST. This list is intended to form a context for the ASWG- discussion to follow.

4k x 4k NIR camera (barebones)
8k x 8k NIR camera extension
Adding IFTS capabilities to NIR/MIR camera
Dedicated NIR coronagraph
Dedicated visible camera (0.6-1+ micron, same format as NIR camera, different scale)
NIR R = 100 spectroscopy (highest possible point source sensitivity)
NIR R=1000 multiplexed spectrograph
NIR, R =3-5000 spectroscopy, likely integral field unit
MIR imager (1kx1k)
MIR spectrograph R=1500
MIR, R=3-5000 spectroscopy, likely integral field unit

New ways of doing business

The ASWG discussed the tight budgetary restrictions on NGST and especially the ISIM. The committee supports efforts to reduce the overall costs of the scientific instruments, even if it requires reconsidering the usual AO-PI-Turnkey-instrument delivery mode of HST and many other major observatories. However, it is not clear what the optimum model is. An ad hoc meeting of non-NGST engineers, managers, and astronomers are meeting on Nov. 8-9 to consider new paradigms for constructing the ISIM.

ASWG- Executive Session (Nov. 4th-Nov.5th)

Using the Technical Panel parametric cost estimates and the estimated costs for the ISIM infrastructure, the ASWG- attached rough cost estimates on the scientific capabilities listed above. It also redefined the capabilities in greater detail. After a great deal of discussion, the ASWG- provided a strawman ranking of science capabilities. This ranking was presented to John Mather, upon his return from the Galvaston meeting. This Much of the last day was devoted to raising technical issues that should be addressed before the Belmont meeting. Because of the preliminary nature of the ASWG- rankings, we do not list them here.

Key Questions to address before the Nov. 22-23 Meeting

Visible band feasibility (QE, MTF, red leak, sensitivity)
Telescope PSF in the visible
Possibility of adding a coronagraphic capability to the NIR and MIR cameras
Feasibility of 3'x 3' spectrograph (what is scattering/leakthrough) of mirrors/apertures.
Relative cost of 2' x 2' NIR camera to the 4' x 4' camera
More detail on the costs and risks of MEMS technologies

Cost and Implications of a dedicated guider

Revisit the number counts of interesting objects in the various IFU/MOS/Multi-slit/IFTS fields.

Key Agenda Items for Nov. 22-23 Meeting

. IFU/MEMS/Slits/IFTS revisit
. Answers to technical questions (see above)
. Technical panel update (cost, cost for tech development, more detail about MEMS)
. Capabilities Reprioritization
. Packaging of capabilities into instrument concepts
. Viewgraphs for Tripartite meeting in December
. Revised ASWG subcommittee reports
. Role and future of the ASWG

Homework for ASWG members

1. Visible-Near-IR redleak. The difficulty of making a perfect blocking filter has been raised as a serious issue for extending the NIR camera into the visible (0.6 microns). However, the scientific requirements for the long-pass blocking factor is poorly defined. We urge the ASWG members to consider the requirements for their specific science programs in the DRM and send their requirements (and an explanation) to Harry Ferguson at the STScI who will compile them. One of the key requirements is that leakthrough of zodiacal light not increase the apparent background in a visible band filter (e.g. R or I) by a moderate amount (<20%).

2. Spectroscopic Multiplexing Requirements: The ASWG NIR-spectrograph subcommittee will revisit the requirements for spectroscopic multiplexing in the NIR and for R ~ 1000, particularly for the high-z galaxy observations. Authors of DRM programs or other high-priority science programs using multiplexed NIR spectroscopy may wish to contact Marcia Rieke and provide number densities and characteristic angular scale lengths of their targets.

3. Advocacy: ASWG members should continue to advocate the NGST mission. If members have contacted congressional staff members regarding NGST or NASA, a thank-you letter would be appropriate. Although the Atlanta AAS meeting is not a major exposition for NGST, members are encouraged to attend, visit the NGST booth, and answer questions regarding NGST at the special lunchtime session on January. 12$^{th.}$

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